

Question 5 (11 marks)

A group of conservationists is studying the number of nestlings (baby birds) in kookaburra nests throughout one region in South Australia. The conservationists find that, in this region, the number of nestlings, X , can be represented using the distribution below.

x	1	2	3	4	5	6
$\Pr(X = x)$	0.22	0.28	c	0.12	0.05	0.03



Source: adapted from Barcaldine Regional Council, www.abc.net.au

- (a) Calculate c , the probability that a randomly selected kookaburra nest in this region contains three nestlings.

$$c = 1 - 0.22 - 0.28 - 0.12 - 0.05 - 0.03$$

$$= 0.3$$

(1 mark)

- (b) Find the mean number of nestlings per kookaburra nest in this region.

$$\mu_x = 1 \times 0.22 + 2 \times 0.28 + 3 \times 0.3 + 4 \times 0.12 + 5 \times 0.05 + 6 \times 0.03$$

$$= 2.59$$

(1 mark)

The conservationists believe that during a period of drought, an entire family of kookaburras will survive *only* if their nest contains three or fewer nestlings.

- (c) Calculate the probability that a randomly chosen kookaburra nest in this region contains three or fewer nestlings.

$$P(X \leq 3) = 0.22 + 0.28 + 0.3$$

$$= 0.8$$

(1 mark)

- (d) The conservationists want to understand the likelihood that entire families of kookaburras will survive a period of drought. They randomly select a sample of 20 kookaburra nests in this region and record the number of nestlings in each nest.

- (i) Let Y represent the number of kookaburra nests in the sample that contain three or fewer nestlings.

Fill in the boxes below to define Y , indicating the type of distribution and its associated parameters.

$$Y \sim \boxed{B} \left(\boxed{20}, \boxed{0.8} \right)$$

(2 marks)

- (ii) Calculate the probability that more than half of the nests in the sample contain three or fewer nestlings.

$$P(Y > 10) = 0.997 \text{ (3s.f.)}$$

(2 marks)

- (iii) Find the mean and standard deviation of Y .

$$\mu_Y = 20 \times 0.8 = 16$$

$$\sigma_Y = \sqrt{20 \times 0.8 \times 0.2} = 1.79 \text{ (3s.f.)}$$

(2 marks)

- (iv) Comment on what your results from parts (d)(ii) and (d)(iii) suggest about the likelihood that entire families of kookaburras in this region will survive a period of drought.

- It is almost certain that more than half of the families will survive
- We would expect about 80% of the families to survive.
- The spread of data values around the mean is fairly small

(2 marks)